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Calculating MAOP for pre-1970 pipe

US DOT PHMSA Office of Pipeline Safety

Topics Areas for Discussion

- Applicable Regulations
- Required Records
- Prior PHMSA Guidance

Subpart A–General

- 192.3 Definitions.
- 192.5 Class locations.

These are fundamental building blocks to correctly determining MAOP

Class Location Definition §192.5

- The class location unit is an onshore area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline.
- The class location is determined by the buildings in the class location unit. For the purposes of this section, each separate dwelling unit in a multiple dwelling building is counted as a separate building intended for human occupancy.
- Clustering is allowed and must be performed correctly

Subpart C–Pipe Design

- 192.105 Design formula for steel pipe.
- 192.107 Yield strength (S) for steel pipe.
- 192.109 Nominal wall thickness (t) for steel pipe.
- 192.111 Design factor (F) for steel pipe.
- 192.113 Longitudinal joint factor (E) for steel pipe.
- 192.115 Temperature derating factor (T) for steel pipe.
- 192.121 Design of plastic pipe.
- 192.123 Design limitations for plastic pipe.

Subpart J–Test Requirements

- 192.501 Scope.
- 192.503 General requirements.
- 192.505 Strength test requirements for steel pipeline to operate at a hoop stress of 30 percent or more of SMYS.
- 192.507 Test requirements for pipelines to operate at a hoop stress less than 30 percent of SMYS and above 100 psig.
- 192.509 Test requirements for pipelines to operate below 100 psig.
- 192.511 Test requirements for service lines.
- 192.513 Test requirements for plastic pipelines.
- 192.515 Environmental protection and safety requirements.
- 192.517 Records.

Subpart L–Operations

- 192.609 Change in class location: Required study.
- 192.611 Change in class location: Confirmation or revision of maximum allowable operating pressure.
- 192.619 Maximum allowable operating pressure: Steel or plastic pipe-lines.
- 192.621 Maximum allowable operating pressure: High-pressure distribution systems.
- 192.623 Maximum and minimum allowable operating pressure: Low-pressure distribution systems.

Records

Records provide evidence of the fundamental basis for many justifications and decisions an operator can make under Part 192.

Operators must keep records to prove that they have determined the MAOP in accordance with the regulations.

"Records" in a Code Section Title

- 192.491 Corrosion control records.
- 192.517 Records. *(for Subpart J – Test Requirements)*
- 192.947 What records must an operator keep? *(for Subpart O – IMP)*
- 192.1011What records must an operator keep? *(for Subpart P – DIMP)*

Records in other Significant Places

- §192.553 General requirements… (b) Records. Each operator who uprates a segment of pipeline shall retain for the life of the segment a record of each investigation required by this subpart, of all work performed, and of each pressure test conducted, in connection with the uprating.
- §192.603 General provisions… (b) Each operator shall keep records necessary to administer the procedures established under § 192.605 for operations, maintenance, and emergencies including class location and changes in §§ 192.5, 192.609 and 192.611.

Calculating MAOP for pre-1970 pipe

- Let’s dive into it (again)!

§192.619 – MAOP Calculations Steel or Plastic Pipelines

Lowest of the following:

- (a)(1) Design
- (a)(2) Test Pressure
- (a)(3) MOP during the 5 years preceding July 1, 1970
- (a)(4) Maximum Safe Pressure determined by the Operator

192.619(a)(1) - Design of Pipe and Components

- The design pressure of the weakest element in the segment, determined in accordance with Subparts C and D of this part.
- Pipe
  - For Steel - §192.105
  - For Plastic - §192.121
- Components - Rating established by the Manufacturer - built and tested to standards required by Part 192

§192.619(a)(2)
Test Pressure - Steel > 100 psi

	Factors[1], segment		
Class location	Installed before Nov. 12, 1970	Installed after Nov. 11, 1970	Covered under §192.14
1	1.1	1.1	1.25
2	1.25	1.25	1.25
3	1.4	1.5	1.5
4	1.4	1.5	1.5

§192.619 – MAOP

- Lowest of the following:
- (a)(1) Design
- (a)(2) Test Pressure
- (a)(3) MOP during the 5 years preceding July 1, 1970
- (a)(4) Maximum Safe Pressure determined by the Operator

192.619(a)(3) – MP5

- High MOP during 5 years preceding 7/1/70
- Unless:
  - Tested in accordance §192.619(a)(2) after July 1, 1965 OR
  - Uprated in accordance with Subpart K of this part.
- The exception for using this 5 year "window" pressure is if the line was tested in the "window" or has gone through an uprate during this "window". If the line has gone through either of these in this 5 year window, the MP5 is not applicable.

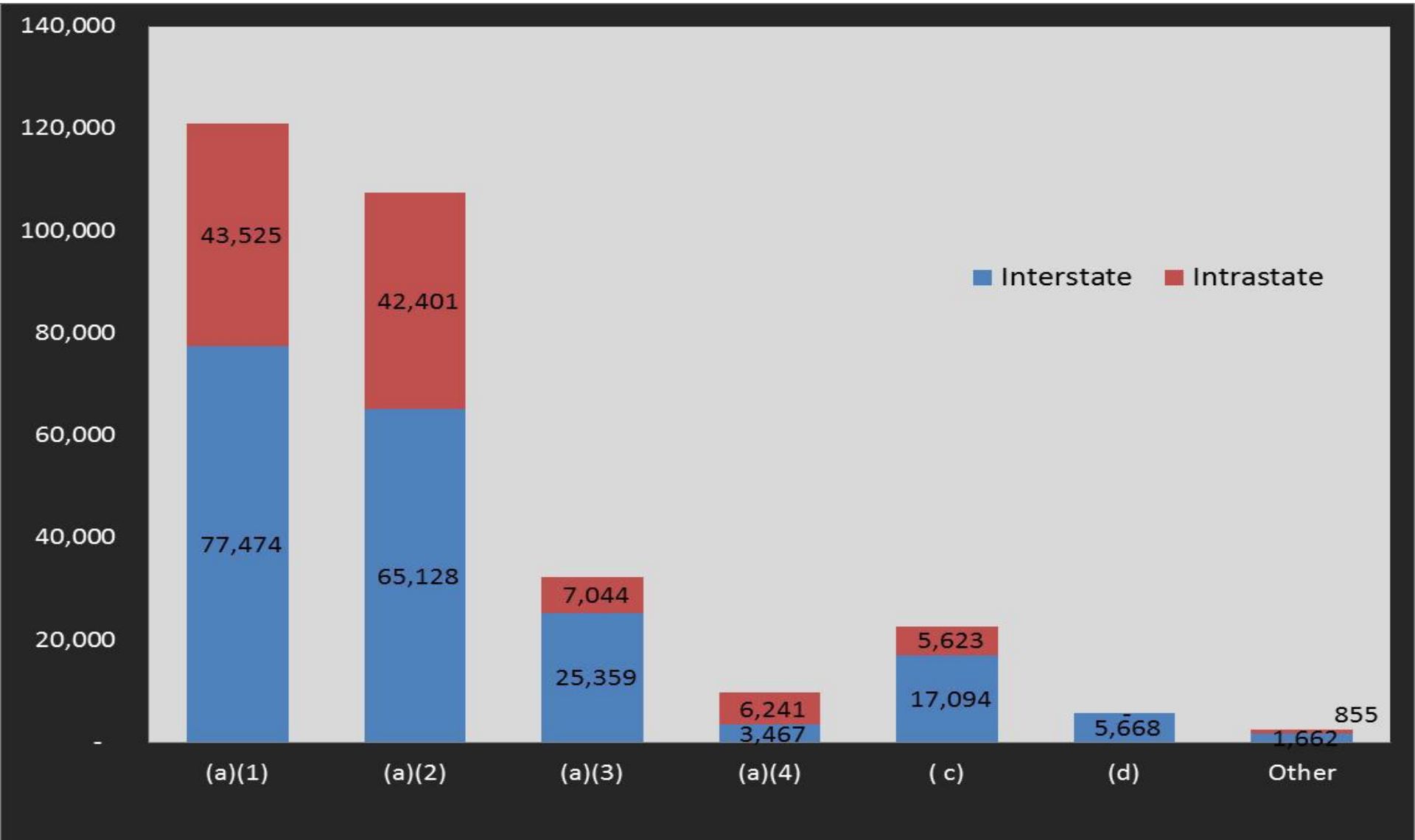
§192.619 (a)(4)
Maximum Safe Pressure

- The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressure.
- The Maximum Safe Pressure determination by the operator is a derating factor only. That is, based on the operating history or known problems of the line, the operator can establish a lower MAOP for the line.

§192.619(c) Grandfather Clause

§192.619(c) The requirements on pressure restrictions in this section do not apply in the following instance. An operator may operate a segment of pipeline found to be in satisfactory condition, considering its operating and maintenance history, at the highest actual operating pressure to which the segment was subjected during the 5 years preceding the applicable date in the second column of the table in paragraph (a)(3) of this section. An operator must still comply with §192.611.

Total GT Miles 192.619 MAOP Method data as of 7-1-2013 from Part Q



Part Q – Grandfather Interlude

- 192.619(a)(3) IS NOT the grandfather clause
  - Under 619(a), MAOP is limited to the lowest of four criteria – design, pressure test, operating pressure in 5 years preceding 1970, and pipeline history
  - For miles reported under 619(a)(3), the operating pressure in 5 years preceding 1970 is less than the allowable pressure derived from design, pressure test, and pipeline history
- 192.619(c) IS the grandfather clause

§192.619(c) from Previous Example

In our previous example, all relevant records were available and there was a pressure test conducted.

- Design = 720#
- Test Pressure = 1071#
- MOP = 850#

The grandfather clause allows the MAOP of this line to be set at 850#. The reason the line is allowed to operate above the working pressure of the ANSI 300 flange is because the component has proved itself in place under pressure and did not fail. This MAOP will be 850# as long as the line stays in satisfactory condition and there are no changes to components or changes to class location.

The Grandfather Clause

The intent of §192.619(c) is to allow existing pipeline segments to continue operating at a specified pressure which will not exceed MP5 (maximum pressure in the five years prior to a pipeline segment becoming regulated).

MP5 Pressure Gradients

MAOPs based on MP5 pressure gradients may still apply. As an example, the MP5 pressure at the discharge side of compressor station "A" may be greater than the MP5 pressure at the suction side of compressor station "B". In this case, established MAOPs along a segment or section may differ. The guiding principal is that the MAOP of an element inside the segment cannot exceed its old (MP5) operating level.

If a pressure gradient is used, controls must be in place to account for the pressure gradient!

Class Location Changes

- Regardless of when placed in service, pipelines that have changes in class to Class 2, 3 and 4 locations cannot operate above the hoop stress that is commensurate with the present class location, unless the MAOP has been confirmed or revised (or is being confirmed or revised due to a recent class location change) in accordance with §192.611.
- Segments with MAOP established by §192.619(c) with class changes are not exempted from the requirements of §192.611.

Class Location Changes

Class location changes occur at the time of the change in population density, and not at the time the operator notices the change.

In other words, *class location changes happen even when you are not paying attention!*

Class Location Changes

- Following a class location change, the operator must immediately conduct a study in accordance with § 192.609.
- If the established MAOP is not commensurate with the new/updated class location's design factor (as determined in 192.619(a)(1)),the operator *must* confirm or revise the MAOP in accordance with § 192.611.
- This confirmation or revision must take place within 24 months. See § 192.611(d).

Prior PHMSA Guidance posted on Web

In 1998, PHMSA released a document titled "Determination of Maximum Allowable Operating Pressure in Natural Gas Pipelines – Instructions."

It was meant to help operators work through the MAOP calculations, but it does not undermine or change the regulation.

These instructions emphasized that the MAOP must be the lowest pressure determined in accordance with Sections 192.619, 192.621, and 192.623. The instructions also reiterated that records must be kept to substantiate the MAOP.

Examples of a Probable Violation

1. Operator's listed MAOP exceeds the criteria of §192.619.
2. All applicable elements required in a MAOP calculation were not adequately documented.
3. Actual operating pressure exceeded MAOP, without the occurrence of an equipment malfunction or failure.
4. Operator has no means to prevent the pipeline from being operated above the MAOP.
5. No records to substantiate the established MAOP.
6. Undocumented or unaddressed class location changes.

Questions and Answers?